2008 Solar Annual Review Meeting

Session: CPV
Company or Organization: MicroLink Devices
Funding Opportunity: PV Incubator

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Budget and Solar America Initiative Alignment

Company or Organization			
Project Beginning Date	**FY07 Budget**	**FY08 Budget**	**Total Budget**
	$ 1.969 M	$ 1.231 M	$ 3.2 M

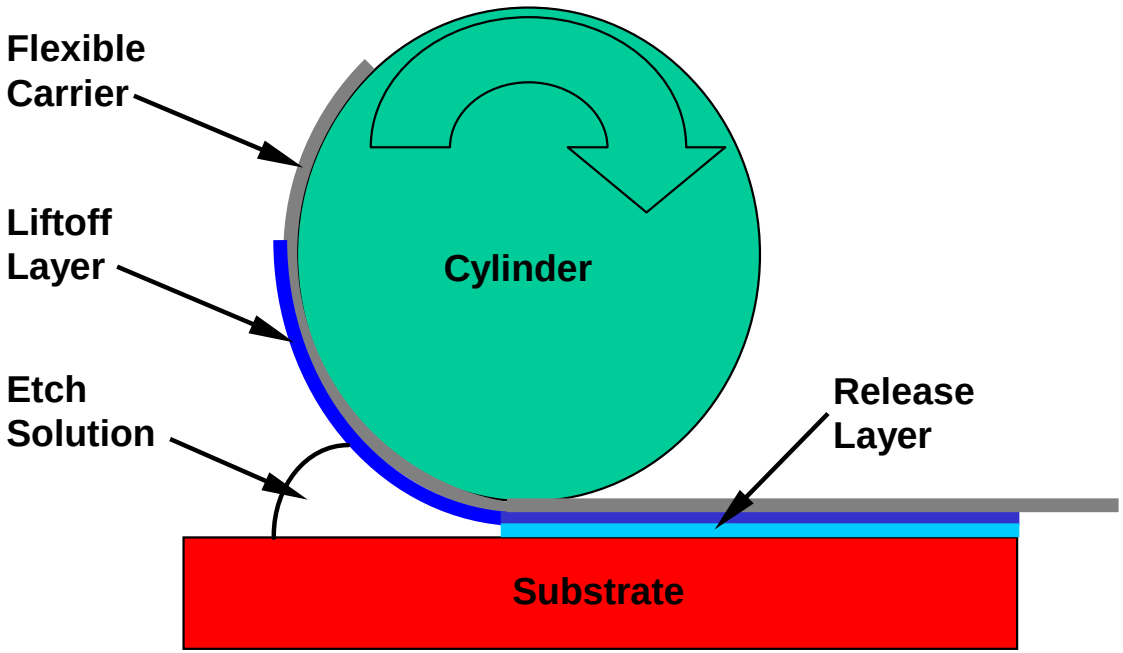
- This project supports the Solar America Initiative by:
  - Reducing the cost of multijunction solar cells by up to 50% while maintaining cell efficiency.
  - Cost reduction is obtained by lifting off a thin film containing the cells from a complete GaAs wafer and reusing the wafer.

Project Overview 1

- Goal is to produce inverted, dual-junction, high efficiency concentrator cells using a wafer-scale epitaxial liftoff process with a final target of 27% efficiency at 1 sun AM1.5
  - Reuse GaAs substrate multiple times to reduce cost
- Integrate cells into concentrator modules and measure performance
  - Collaborate with Amonix for packaging and test

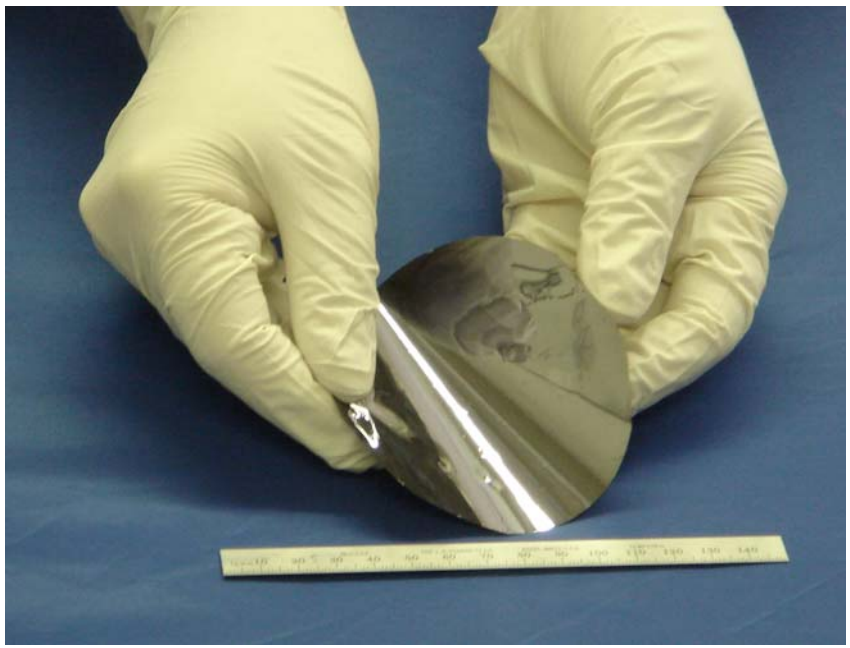
Project Overview 2

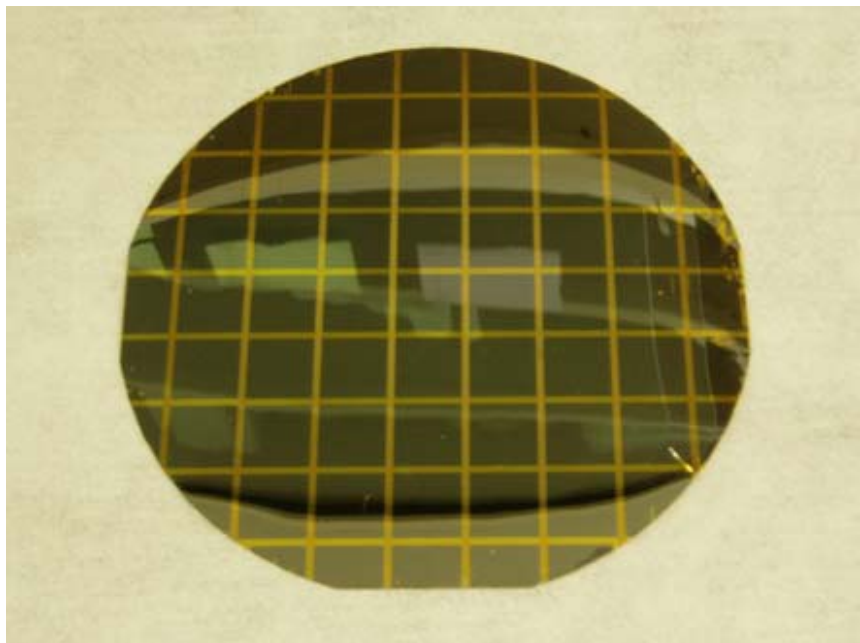
- Grow solar cell structure on GaAs substrate
- Apply flexible carrier to top of solar cell structure
- Remove a release layer by chemical process
- Solar cell layer lifts off
- Final processing



Project Overview 3

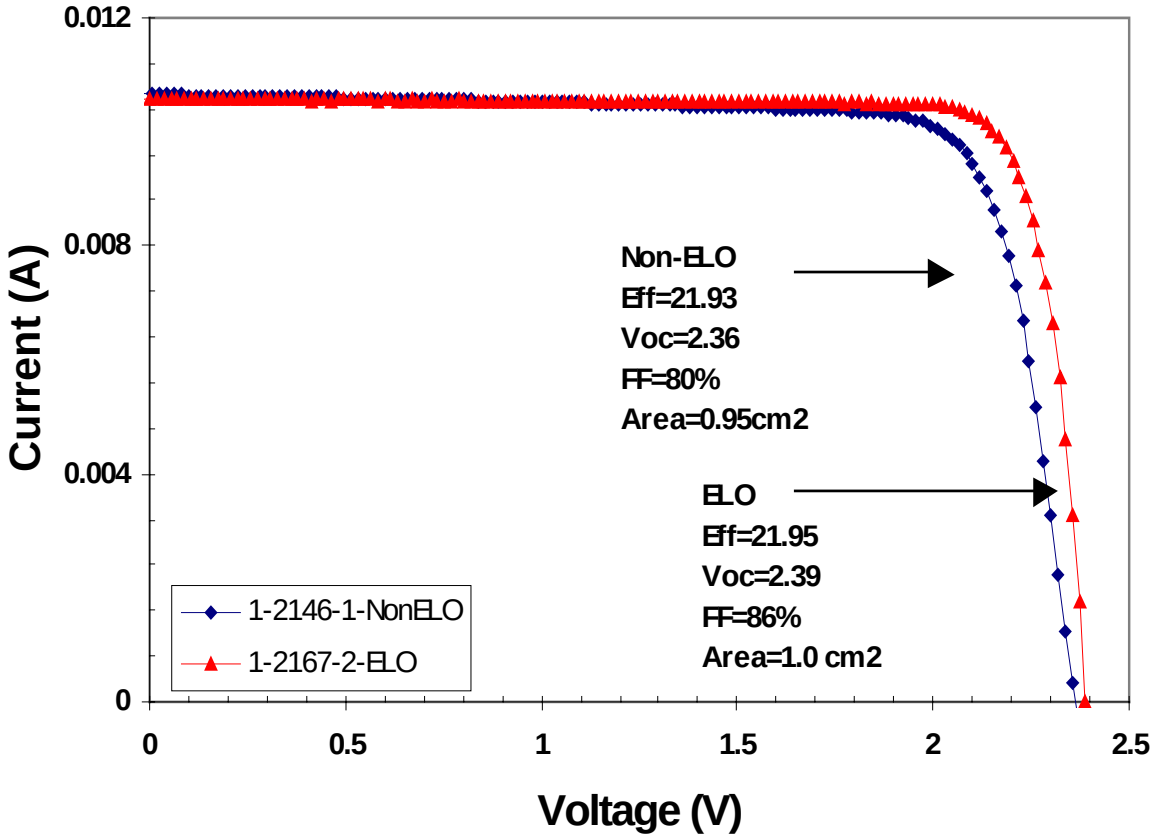
- Solar cell is flexible; resembles thin foil
  - Robust against manual handling
- Attach to temporary carrier for processing
- Fabricate complete wafer of 1 x 1 cm cells



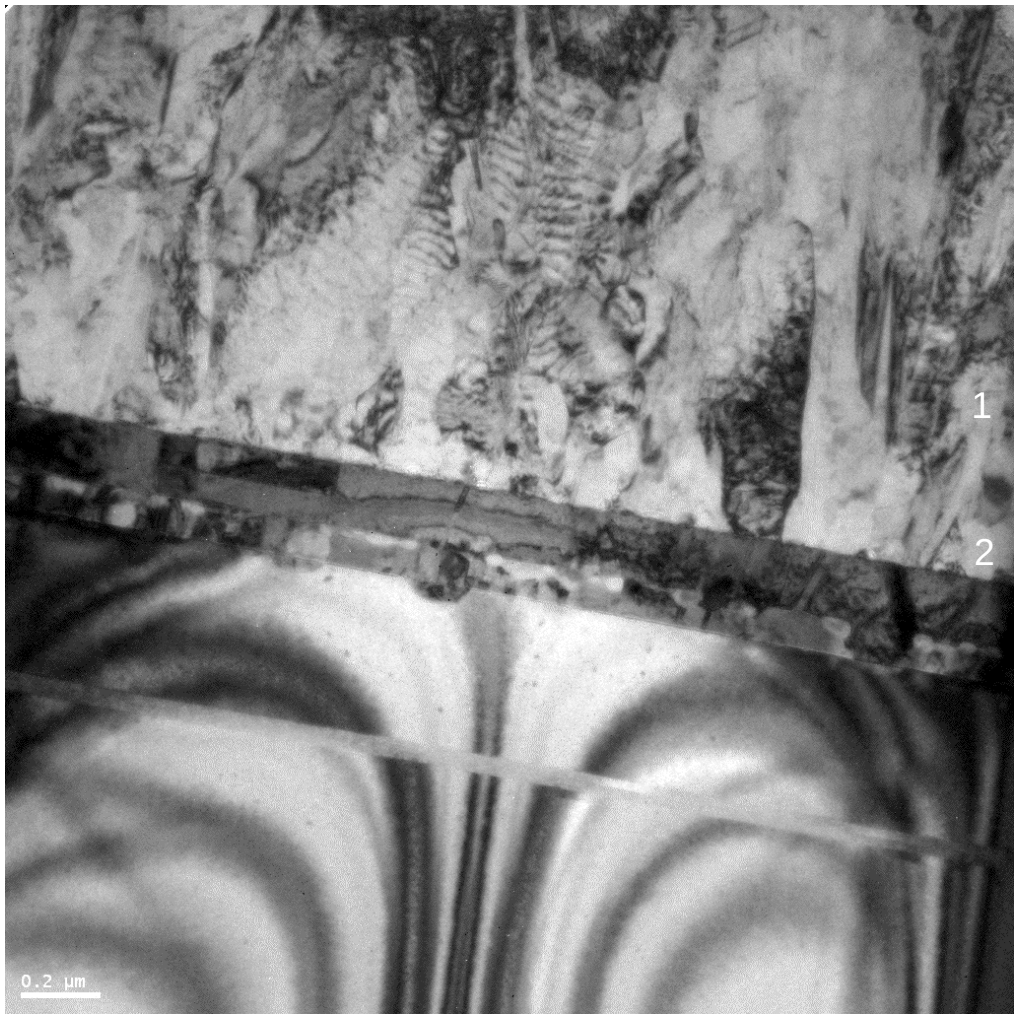


Project Overview 4

- Standard and ELO cells showed nearly identical performance



Project Overview 5
TEM X-section of Metal- GaAs ELO interface



Metal handle substrate

Metal bonding bi-layer

GaAs

InGaP BSF

1-2148-7

Project Overview 6
6-inch GaAs ELO

ELO GaAs Wafer

Project Alignment with Technology Roadmap

Technology Roadmap Needs	MicroLink Approaches
Reduce system cost	Use liftoff to remove solar cell from GaAs substrate. Reuse the substrate multiple times allowing 50% solar cell cost reduction
Establish reliability of prototypes	Test liftoff cells in concentrators
Increase system efficiency	Thin liftoff cells have low thermal conductivity and operate at lower temperature which increases efficiency
Develop next-generation, high-efficiency cell structures	Liftoff potentially allows wafer bonding, which could result in efficient, multijunction cells

Project Update

Past

Future

Planned work since last Program Review	Status
Definition of liftoff cell specification	Complete Dec 07
Construction of a model of multijunction cell structures	In process Apr 08
Cell fabrication and test iteration 1: goal is 22% efficient liftoff dual junction at 1 sun AM1.5	Complete Apr 08
Develop efficient solar cell junctions: Peak QE of GaAs junction > 80%; Peak QE of InGaP junction > 80%	Complete Feb 08
Optimize composition and thickness of top metal	Complete Feb 08
Optimize composition and thickness of grid metal	Complete Feb 08
Design package for solar cells (Amonix)	Complete Feb 08
Develop and test package for solar cells (Amonix)	In process Apr 08
Stage gate goals include 25% efficient liftoff dual junction at 1 sun and cell packaging	In process Apr 08

Obstacle Discussion

- Barriers encountered or anticipated that may inhibit success of programs
  - Mounting the liftoff cell on a heatsink has not yet been attempted. We expect that a modified surface mount process will permit satisfactory mounting.
  - Liftoff of a triple junction cell has not been attempted. Triple junction cells will likely be needed to achieve competitive efficiencies. We expect our process to allow liftoff of efficient triple junction cells.
  - Solar cell structure is inverted. There are potential problems associated with the sequence in which layers of different dopant densities are grown. Significant progress was made in April 2008